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Age, training, and previous experience predict race performance in long-distance inline skaters, not anthropometry

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Abstract: The association of characteristics of anthropometry, training, and previous experience with race time in 84 recreational, long-distance, inline skaters at the longest inline marathon in Europe (111 km), the Inline One-eleven in Switzerland, was investigated to identify predictor variables for performance. Age, duration per training unit, and personal best time were the only three variables related to race time in a multiple regression, while none of the 16 anthropometric variables were related. Anthropometric characteristics seem to be of no importance for a fast race time in a long-distance inline skating race in contrast to training volume and previous experience, when controlled with covariates. Improving performance in a long-distance inline skating race might be related to a high training volume and previous race experience. Also, doing such a race requires a parallel psychological effort, mental stamina, focus, and persistence. This may be reflected in the preparation and training for the event. Future studies should investigate what motivates these athletes to train and compete.

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**AGE, TRAINING AND PREVIOUS EXPERIENCE PREDICT RACE
PERFORMANCE IN LONG-DISTANCE INLINE SKATERS, NOT
ANTHROPOMETRY**

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Summary.— The association of characteristics of anthropometry, training and previous experience with race time in 84 recreational long-distance inline skaters at the longest inline marathon in Europe (111 km), the ‘Inline One-eleven’ in Switzerland, was investigated using bi- and multivariate analysis in order to determine predictor variables for performance. After bivariate analysis, all 16 anthropometric variables correlated between 0.22 and 0.45 with race time, while more specific training variables correlated from .33 to 0.71 to race time. Age, duration per training unit and personal best time in the ‘Inline One-eleven’ were the only three variables to race time in a multiple regression ($r^2=.75$) while none of the 16 anthropometric variable was related. Anthropometric characteristics seem to be of no importance for a fast race time in a long-distance inline skating race in contrast to training volume and previous experience, when controlled with co-variables. Improving performance in a long-distance inline skating race might lead over a high training volume and previous race experience. Also, doing such a race requires a parallel psychological effort, mental stamina, focus, and persistence. This may be reflected in the preparation and training for the event. Future studies should investigate what motivates these athletes to train and compete.

In endurance athletes, the association of anthropometric characteristics, such as body mass, body height, Body Mass Index, both the length and the circumferences of limbs, body fat and the skin-fold thicknesses with performance has been investigated in the disciplines of swimming, cycling, running, inline skating and the combination as triathlon. Body mass was related to performance in runners (Hagan, Smith, & Gettman, 1981; Kenney & Hodgson, 1985; Knechtle, Duff, Welzel, & Kohler, 2009a), road (Swain, 1994) and off-road cyclists (Gregory, Johns, & Walls, 2007; Impellizzeri, Rampinini, Sassi, Mognoni, & Marcora, 2005), for whom with lower body mass had an advantage in climbing. Body height was significantly associated with performance in swimming (Geladas, Nassis, & Pavlicevic, 2005; Knechtle, Baumann, Knechtle, & Rosemann, 2010a; Siders, Lukaski, & Bolonchuk, 1993; Zampagni, Casino, Benelli, Visani, Marcacci, & De Vito, 2008) and inline skating (Knechtle, Knechtle, Rosemann, & Lepers, 2010). Body Mass Index and endurance performance showed an association in ultra-runners (Hoffman, 2008) and ultra-swimmers (Knechtle, *et al.*, 2010a). The circumferences of limbs were related to the performance in ultra-endurance runners (Tanaka and Matsuura, 1982; Lucia *et al.*, 2006; Knechtle, Knechtle, Schulze, & Kohler, 2008; Knechtle, *et al.*, 2009a). The length of the arms was related to swimming performance (Knechtle, *et al.*, 2010a). Body fat showed an association with race performance in female marathon runners (Hagan, Upton, Duncan, & Gettman, 1987), in male ultra-marathoners (Hoffman, Lebus, Ganong, Casazza, & VanLoan, 2010) and in female swimmers (Siders, *et al.*, 1993; Tuuri, Loftin, & Oescher, 2002). This shows that different anthropometric characteristics were diversely related to performance in the various endurance disciplines. These data show also that the relationship of anthropometry with endurance performance has been investigated in terms of many different characteristics across different disciplines. However, there seems no clear pattern in the correlations when only bi-variate correlations between anthropometric characteristics and performance were performed.

Among the different anthropometric variables, the skin-fold thicknesses seem to be of higher importance since the skin-fold thicknesses seem to correlate with training in the pre-race preparation of highly-trained runners (Legaz Arrese, González Badillo, & Serrano Ostáriz, 2005). Legaz and Eston (2005) showed in top class runners that training resulted in both a significant increase in performance and a decrease in both the sum of six skin-folds and single skin-folds such as abdominal, front thigh and medial calf skin-fold. The improvements in performance were consistently associated with a decrease in the lower limb skin-folds. The authors concluded that the lower limb skin-folds may be particularly useful predictors of running performance. It has been shown that the skin-fold thickness of both the front thigh and the medial calf (Arrese & Ostáriz, 2006) as well as the total sum of five skin-fold thicknesses were related to race performance in male 10-km runners (Bale, Bradbury, & Colley, 1986). In ultra-marathoners, the medial calf skin-fold thickness was related to race time (Knechtle, & Rosemann, 2009a). Additionally, the sum of seven skin-folds was correlated to marathon performance times (Hagan, *et al.*, 1981) and the sum of eight skin-folds was associated with race time (Knechtle, Knechtle, & Rosemann, 2009c). In contrast to the highly trained runners of Arrese and Ostáriz (2006), the skin-fold thicknesses of the upper body were related to half-marathon performance in recreational female runners (Knechtle, Knechtle, Rosemann, & Senn, 2010f; Knechtle, Knechtle, Barandun, Rosemann, & Lepers, 2011a) and Ironman performance times in recreational male Ironman triathletes (Knechtle, Knechtle, & Rosemann, 2011b).

Apart from anthropometry, volume and intensity of training also influence the performance in endurance athletes, mainly in runners (Bale, *et al.*, 1986; Billat, Demarle, Slawinski, Paiva, & Koralsztein, 2001; Hewson, & Hopkins, 1996; Knechtle, Knechtle, Rosemann, Lepers, 2010e; Scrimgeour, Noakes, Adams, & Myburgh, 1986; Yeung, Yeung, & Wong, 2001). In marathoners, the longest mileage covered per training session was the best predictor variable for a successful completion of a marathon (Yeung, *et al.*, 2001). Runners

training for more than 100 km per week had significantly faster race times over 10 km to 90 km than athletes covering less than 100 km running in training during one week (Scrimgeour, *et al.*, 1985). Elite runners with a higher training frequency, a higher weekly training volume and a longer running experience showed faster running times over 10 km (Bale, *et al.*, 1986). Top-class marathon runners trained for more total kilometres per week and at a higher velocity than runners at a lower level (Billat, *et al.*, 2001). Additionally, peak running velocity in training was highly related to 5-km run times for both male and female athletes (Scott, & Houmard, 1994).

In addition to training, previous experience was also associated with endurance performances, as has been described for Ironman triathletes (Gulbin, & Gaffney, 1999; Knechtle, Wirth, & Rosemann, 2010h), Triple Iron ultra-triathletes (Knechtle, Knechtle, Rosemann, & Senn, 2011e), ultra-marathoners (Knechtle, Wirth, Knechtle, Zimmermann, & Kohler, 2009d; Knechtle, Wirth, Knechtle, & Rosemann, 2010g; Knechtle, Knechtle, & Rosemann, 2010c; Knechtle, Knechtle, Rosemann, & Lepers 2011c), and ultra-mountain bikers (Knechtle, Knechtle, Rosemann, & Senn, 2011d). A previous best performance in an Olympic distance triathlon coupled with both the weekly cycling distances and the longest training ride could partially predict Ironman race performances (Gulbin, & Gaffney, 1999). Personal best time in both an Olympic distance triathlon and a marathon were related to Ironman race time (Knechtle, *et al.*, 2010h; Rüst, Knechtle, Knechtle, Rosemann, & Lepers, 2011). Also, a personal best marathon time was related to performance in 24-h ultra-marathoners (Knechtle, *et al.*, 2009d; Knechtle, *et al.*, 2011c), 100-km ultra-marathoners (Knechtle, *et al.*, 2010e) and in multistage mountain ultra-marathoners (Knechtle, *et al.*, 2010c). Personal best time in mountain ultra-bikers (Knechtle, *et al.*, 2011d) and Triple Iron ultra-triathletes (Knechtle, *et al.*, 2011e) on the original race track was related to race time as the main predictor variable. With increasing age, performance decreases and the age-related decline in endurance performance is well documented. In general, peak endurance

performance is maintained until 30 to 35 years, followed by a moderate decrease until 50 to 60 years, and a progressively steeper decline after 70 to 75 years (Baker, Tang, & Turner, 2003; Balmer, Bird, & Davison, 2008; Donato, Tench, Glueck, Seals, Eskurza, & Tanaka, 2003; Leyk, *et al.*, 2007; Leyk, *et al.*, 2009; Wright, & Perricelli, 2008). In addition to the above cited characteristics of anthropometry, training and previous experience related to endurance performance, age is significantly and positively associated with race time in marathoners (Lepers, & Cattagni, 2011), ultra-marathoners (Knechtle, *et al.*, 2010e; Knechtle, Rüst, Rosemann, & Lepers, 2011f), short-distance triathletes (Bernard, Sultana, Lepers, Hausswirth, & Brisswalter, 2010, Sultana, Brisswalter, Lepers, Hausswirth, & Bernard, 2008) and Ironman triathletes (Lepers, Sultana, Bernard, Hausswirth, & Brisswalter, 2010).

The associations of age, anthropometry, training and previous experience have been investigated in the above mentioned sports' disciplines such as swimming, cycling, running and triathlon, but not for recreational male long-distance inline speed skaters. This is of interest because inline skaters, in contrast to ice skaters, use roller skates with generally four wheels. Recent studies focused especially on pacing and speed skating performance for distances varying from sprint distance of 200 m to 10,000 m (Muehlbauer, Schindler, & Panzer, 2010a; Muehlbauer, Schindler, & Panzer, 2010b; Muehlbauer, Panzer, & Schindler, 2010c). Also, inline skaters use primarily their legs during training and competing. Respecting existing literature on the association between skin-fold thicknesses and training, we intended to investigate the association between both anthropometry and training characteristics with race performance, in male athletes, at the longest inline marathon in Europe, the 'Inline One-eleven' over 111 km in Switzerland. While including all described characteristics reported in the literature, the intention was to find predictor variables for race performance in long-distance inline skaters. We hypothesized to find (i) an association between skin-fold thicknesses of the lower limbs with training and (ii) a relationship between skin-fold thicknesses of the lower limbs and race time.

METHOD

Participants

A total of 92 male athletes volunteered; all gave their informed written consent. The study was approved by the Institutional Review Board for use of Human Subjects of St. Gallen, Switzerland. The athletes came on Saturday, August 15th 2009 to get their race numbers and the instructions for the race. On August 16th 2009 at 07:00 a.m., they began the race. During the 111 km, the organizer offered 11 refreshment points, including the opportunity to repair their shoes in case of a malfunction. Total race time was measured using an electronic chip system.

The 'Inline One-eleven'

The organizer of the 'Inline One-eleven' in St. Gallen, Switzerland contacted all the participants of the race via a separate newsletter three months before the 2009 race, the 12th year of this event. The 'Inline One-eleven' - the longest inline skating race in Europe - covered a total distance of 111 km with a total altitude of 1,400 m to climb. The start of the race was in the heart of the City of St. Gallen with a large loop of 111 km in the East of Switzerland returning to St. Gallen on completely closed routes.

Pre-Race Measures

The day before the start of the race body mass, body height, and the skin-fold thicknesses at eight sites (pectoral, axillar, triceps, subscapular, abdominal, suprailiacal, front thigh, and medial calf) on the right side of the body were measured in order to calculate Body Mass Index, the sum of eight skin-folds, the sum of upper body skin-folds, the sum of lower body skin-folds and percent body fat using an anthropometric method. Body mass was measured using a commercial scale (Beurer BF 15, Beurer GmbH, Ulm, Germany) to the

nearest 0.1 kg. Body height was measured using a stadiometer to the nearest 0.01 m. The skin-fold data were obtained using a skin-fold caliper (GPM-Hautfaltenmessgerät, Siber & Hegner, Zurich, Switzerland) and recorded to the nearest 0.2 mm. All skin-fold measurements were taken once for all eight skin-fold sites, then the procedure was repeated twice more by the same investigator. The mean of the three measurements was then subjected to analysis. According to Becque, Katch, and Moffatt (1986), readings were performed 4 sec after applying the calliper to ensure reliability in skin-fold measurements. One trained investigator took all the skin-fold measurements as inter-tester variability is a major source of error in skin-fold measurements. An intra-tester reliability check was conducted on 27 male runners prior to testing. Intra-class correlation (ICC) was high for all anatomical measurement sites ($ICC > .9$) (Knechtle, Joleska, Wirth, Knechtle, Rosemann, & Senn, 2010b). The circumferences and length of limbs were measured using a non-elastic tape measure (cm) (KaWe CE, Kirchner and Welhelm, Germany) on the right side of the body. The length of the leg was measured from *trochanter major* to *malleolus lateralis* to the nearest 0.1 cm. The circumference of the upper arm was measured in the middle of the upper arm (between *acromion* and *olecranon*) to the nearest 0.1 cm, the circumference of the thigh was taken at the level where the skin-fold thickness of thigh was measured (20 cm above the upper margin of the patella), and the circumference of the calf was measured at the maximum circumference of the calf. The percentage of body fat was calculated using the following anthropometric formula from Ball, Altena, and Swan (2004): Percent body fat = $0.465 + 0.180(\Sigma 7SF) - 0.0002406(\Sigma 7SF)^2 + 0.0661(\text{age})$, where $\Sigma 7SF$ = sum of skin-fold thicknesses of pectoralis, axilla, triceps, subscapular, abdomen, suprailiac, and thigh. The participants recorded their training during three months until the start of the race using a comprehensive training diary. They recorded their training sessions showing the distance and duration in the preparation for the race. The training record consisted of the number of weekly training units in inline skating, showing duration, kilometres, and pace. Mean speed during training was

calculated using distance and time per training session. Furthermore, they reported on the number of years that they had been active inliners, including participation in inline races, as well as the number of completed 'Inline One-eleven' races, including their personal best time for that course.

Statistical Analysis

The Shapiro-Wilks test was used to check for normality distribution. Data are presented as means and standard deviations (*SD*). The coefficient of variation of performance ($CV \% = 100 \times SD/mean$) for total race time was calculated. Race time was also expressed as a percentage of the course record. To reduce the variables for the multiple linear regression analysis, bivariate correlation analysis between the variables of age and characteristics of anthropometry, training and previous experience was performed. In a second step, all significant variables after bivariate analysis entered the multiple linear regression analysis (stepwise, forward selection, p of F for inclusion $< .05$, p of F for exclusion $> .1$).

Multicollinearity between the predictor variables was excluded with $r > 0.9$. A power calculation was performed according to Gatsonis and Sampson (1989). To achieve a power of 80% (two-sided Type I error of 5%) to detect a minimal association between race time and anthropometric variables of 20% (i.e. coefficient of determination $r^2 = .2$) a sample of 40 participants was required. An alpha level of 0.05 was used to indicate significance.

RESULTS

A total of 651 male inliners started in the 'Inline One-eleven' in 2009, and 611 male athletes (94%) arrived at the finish within the time limit of 10 hours. In total, 92 male participants started the race, 84 male participants (91%) finished within 4 hrs. 24 min (CV=15.6%), skating at an average speed of 25.8 (SD=4.0) km/h. Expressed as a percentage of the course record, of 3 hrs. 07 min set by Tristan Loy (France) in 2003, participants' performance was 144 (SD=22) %. Of the 84 participants, 56 had already completed at least one 'Inline One-eleven'. Race time for these experienced finishers in 'Inline One-eleven' (4 hrs. 34 min) was not different for non-experienced finishers (4 hrs. 10 min), respectively. **Table 1** shows the results of the investigated variables including their bivariate association with race time. In the multi-variate association (see **Table 2**), age, duration per training unit and personal best time in 'Inline One-eleven' were related to race time for the 56 experienced participants ($r^2=.75$). The sum of skin-fold thicknesses and both the skin-folds at front thigh and medial calf showed no associations with previous inline training (see **Table 3**).

DISCUSSION

We intended to investigate the associations between anthropometry and training characteristics with race performance, in male athletes, at the longest inline marathon in Europe, the 'Inline One-eleven', over 111 km in Switzerland and hypothesized to find (i) an association between skin-fold thicknesses of the lower limbs with training and (ii) a relationship between the thicknesses of lower limb skin-folds and race time. However, when controlled with the co-variables age, training and previous experience, the results showed that age, duration per training unit and personal best time in an 'Inline One-eleven' were the best variables correlated to race time after multi-variate analysis, but not anthropometric characteristics, such as skin-fold thicknesses. When the mean race time of the participants was compared with the course record, relatively trained people participated in this study but that the results may differ in well trained people or elite athletes.

Anthropometry and its association with training and race time

A first aim was to investigate a potential association between skin-fold thicknesses and training. Respecting existing literature in runners on the association between skin-fold thicknesses and training, we hypothesized to find an association between the thicknesses of skin-folds at the lower limbs with training. However, none of the training variables was related to the skin-folds of the lower limbs. Presumably, these recreational athletes were not training as intense as the high-level runners did (Arrese and Ostáriz, 2006; Legaz and Eston, 2005; Legaz Arrese, *et al.*, 2005). In addition, recreational athletes may train in different disciplines and competing in a long-distance inline skating race may not be the ultimate goal in these athletes. We further hypothesized to find a relationship between the thicknesses of skin-folds of the lower limbs and race time. Although all skin-fold thicknesses except the skin-fold at the triceps were related to race time after bivariate analysis, the significant

associations were eliminated after the multi-variate analysis when correcting with the co-variates of training and previous experience.

A second aim was to investigate a potential relationship between skin-fold thicknesses and race time. The association between skin-fold thicknesses and endurance performance has mainly been investigated in runners where studies over distances from 100 m to ultra-endurance distances had been performed. The length of a running performance and the fitness level of an athlete may determine whether skin-fold thicknesses are related to race performance or not. In male 10-km runners, the total sum of five skin-fold thicknesses was related to performance (Bale, *et al.*, 1986). In male marathoners, the sum of seven skin-folds was correlated to marathon performance times (Hagan, *et al.*, 1981). In male ultra-endurance runners during a 24-h run, skin-fold thicknesses showed no association with performance (Knechtle, *et al.*, 2009d, Knechtle, *et al.*, 2011c) and also during a 100-km ultra-marathon, the sum of skin-folds was not associated with race performance (Knechtle, *et al.*, 2010g). In multistage mountain ultra-marathoners, however, calf skin-fold thickness was related to performance (Knechtle, & Rosemann, 2009a). These findings implicate that skin-fold thicknesses in runners are mainly associated to race performance in rather short-distance trials. It must be emphasized that in these studies only bi-variate analyses were performed. Also, the kind of performance seems to influence the association between skin-fold thicknesses and performance. For recreational cyclists, no association between skin-fold thicknesses and race performance has been reported in ultra-endurance road cyclists (Knechtle, *et al.*, 2009b), or in ultra-endurance mountain-bikers (Knechtle, & Rosemann, 2009b). However, for recreational triathletes competing over the Ironman distance (Knechtle, *et al.*, 2011b) and distances longer than the Ironman distance (Knechtle, *et al.*, 2009c), the sum of eight skin-fold thicknesses was related to race performance.

Apart from the skin-fold thicknesses, also other anthropometric characteristics such as body mass, Body Mass Index, the circumferences of the limbs, and percent body fat were

related to race time after bivariate analysis. The relationship of the physical characteristics of body mass (Gregory, *et al.*, 2007; Hagan, *et al.*, 1981; Kenney, & Hodgson, 1985; Knechtle, *et al.*, 2009a; McLean & Parker, 1989; Swain, 1994), body fat (Hoffman, *et al.*, 2010a; Knechtle, *et al.*, 2009a; Knechtle, *et al.*, 2010g) and skin-fold thicknesses (Arrese, & Ostáriz, 2006; Bale, *et al.*, 1986; Knechtle, *et al.*, 2009b; Knechtle, *et al.*, 2009c; Knechtle, & Rosemann, 2009a, Knechtle, & Rosemann, 2009b) with endurance performance has mainly been investigated in runners, cyclists and triathletes. The finding that body fat was significantly correlated to ultra-endurance performances in these athletes confirmed recent findings of Hoffman, *et al.* (2010a) who described a significant positive correlation between percent body fat and finish time for male ultra-marathoners in a 161-km trail ultra-marathon. However, in other samples of ultra-marathoners, percent body fat was neither related to race time in a 100-km ultra-marathon (Knechtle, *et al.*, 2010g) nor to performance in a 24-h run (Knechtle, *et al.*, 2009d, Knechtle, *et al.*, 2011c). In the latter studies, also other variables such as training and previous experience were included in the analysis. Regarding these studies and the present findings, anthropometric characteristics play no role in an ultra-endurance performance when controlled with co-variables.

Predictor variables for long-distance inline skaters

In contrast to our hypothesis that anthropometric characteristics such as skin-fold thicknesses would be related to race performance in these long-distance inline skaters, other variables such as age, duration per training unit and personal best time in the 'Inline One-eleven' were related to race time after multi-variate analysis. In recent years there has been an increased interest to investigate the effect of aging on endurance performance (Jokl, Sethi, & Cooper, 2004; Leyk, *et al.*, 2007, Leyk, *et al.*, 2009, Wright, & Perricelli, 2008). Over the last decade, the participation of master athletes has increased, especially in long-distance events such as marathon (Jokl, *et al.*, 2004; Lepers, & Cattagni, 2011; Leyk, *et al.*, 2007; Leyk, *et al.*,

2009) and ultra-marathon (Hoffman, Ong, & Wang, 2010b; Hoffman & Wegelin, 2009; Hoffman, 2010) running. In the marathon, for example, the performance of masters has significantly improved (Jokl, *et al.*, 2004; Lepers, & Cattagni, 2011; Leyk, *et al.*, 2007). We assume that long-distance inline skaters need a certain time to prepare for such a long race. Accordingly, age is of importance, because it takes a certain age in order to get enough training and pre-race experience. Among the finishers, 56 athletes had already completed the 'Inline One-eleven' and were experienced in participating and finishing a long-distance inline skating race whereas 28 inliners started for the first time in this race. Interestingly, race time was no different between the two groups. The personal best time in 'Inline One-eleven' remained significant in the multi-variate analysis and confirms recent findings that the personal best time on a race track is an important predictor variable for ultra-endurance performance (Knechtle, *et al.*, 2011d, Knechtle, *et al.*, 2011e). Apart from age and personal best time, the stepwise multiple regression showed that duration per training unit in inline skating was the only training variable significantly correlated with time performance. It must be assumed that the duration in training was of higher importance than the speed. For runners, McKelvie, Valliant, and Asu (1985) described that the training pace was important in runners where faster workouts were associated with faster marathon times. Billat, *et al.* (2001) concluded that top-class marathon runners trained for more total kilometres and at a higher velocity compared to high-level marathon runners. Due to the extreme mental demands of such a race, prior experience with the event, or a similar endurance event such as similar distances done while training, should be a primary predictor of performance because it allows a 'cognitive map' for the person about what is required. Also, it allows them a sense of 'beginning and end', and shows them that they can indeed do the exertion. The development of mental toughness is a long-term process that encompasses a multitude of underlying mechanisms that operate in a combined, rather than independent, fashion (Connaughton, Wadey, Hanton, & Jones, 2008). In triathletes, perfectionistic personal standards, high

performance-approach goals, low performance-avoidance goals, and high personal goals predict race performance (Stoeber, Uphill, & Hotham, 2009). Also, doing such a race requires a parallel psychological effort, mental stamina, focus, and persistence. This may, for example, be reflected in the preparation and training for the event. Mentally tough athletes are focused and competitive during training as key attributes for a winning mentality (Coulter, Mallett, & Gucciardi, 2010). ‘Winning by all means’ and ‘working hard’ were the two main dimensions for the belief of success in track and field athletes (Veligekas, Mylonas, & Zervas, 2007).

Limitations and implications for future research directions

This study is limited that nutrition was not included (Peters, 2003). Also weather might have had an impact on performance (Ely, Cheuvront, Roberts, & Montain 2007; Vihma 2010; Wegelin & Hoffman 2011). In future studies the aspect of motivation needs to be further evaluated in long-distance athletes.

CONCLUSIONS

To summarize, age, duration per training unit and personal best time in ‘Inline One-eleven’ predicted race time whereas no anthropometric variable was related to race time after multi-variate analysis. Anthropometric characteristics seem to be of lower importance for a fast race time in contrast to training volume and previous experience, when controlled with co-variables. Improving performance in a long-distance inline skating race might lead over a high training volume and previous race experience. Also, doing such a race requires a parallel psychological effort, mental stamina, focus, and persistence. This may, for example, be reflected in the preparation and training for the event. Future studies should investigate what motivates these athletes to train and compete.

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TABLE 1

Age, Anthropometry, Training, Experience and bivariate Association with Race Time

	<i>Mean</i>	<i>SD</i>	<i>r</i>	<i>p</i>
Age, yr.	40.2	10.2	.30	.0056
Body mass, kg	75.9	9.7	.42	.0001
Body height, m	1.77	0.06	.17	
Body mass index, kg/m ²	24.0	2.7	.35	.0011
Length of leg, cm	86.7	4.5	.04	
Length of arm, cm	81.2	4.0	.10	
Circumference of upper arm, cm	30.1	2.3	.32	.0026
Circumference of thigh, cm	56.2	3.0	.29	.0067
Circumference of calf, cm	38.3	2.3	.38	.0004
Skin-fold pectoral, mm	8.3	4.4	.40	.0002
Skin-fold axillar, mm	9.6	3.8	.37	.0005
Skin-fold triceps, mm	7.8	3.0	.16	
Skin-fold subscapular, mm	10.5	4.2	.38	.0004
Skin-fold abdominal, mm	17.2	9.4	.47	.0001
Skin-fold suprailiacal, mm	18.1	8.4	.42	.0001
Skin-fold front thigh, mm	13.3	6.9	.22	.0484
Skin-fold medial calf, mm	6.2	2.8	.27	.0119
Sum of upper body skin-folds, mm	71.7	29.6	.45	.0001
Sum of lower body skin-folds, mm	19.6	9.1	.25	.0228
Sum of eight skin-folds, mm	91.3	36.3	.43	.0001
Percent body fat, %	16.4	4.8	.45	.0001
Years as active inliner, yr.	7.5	3.7	.07	
Weekly training units, n	2.6	3.3	-.14	
Distance per training unit, km	31.4	9.0	.14	
Duration per training unit, min	97.2	28.0	.33	.0031
Speed during training, km/h	22.7	4.8	-.46	.0001
Completed 'One-eleven', n	3.5	2.7	.04	
Best time at 'One-eleven', min	257.8	42.3	.71	.0001

Note. Results are presented as mean and standard deviation (SD). *P*-values are inserted in case of a significant association.

TABLE 2

Stepwise Multiple Regression Analysis with Race Time as the Dependent Variable

	Unstandardized coefficients		Standardized Coefficients	<i>t</i>	<i>p-value</i>
	<i>B</i>	<i>SE</i>	β		
Step 1					
Best time at 'One-eleven'	.93	0.11	.80	7.44	<.0001
<i>Step 1 R=.71, R²=.50, adjusted R²=.49, F_{dt}=55.34, p<.0001</i>					
Step 2					
Duration per training unit	.16	.12	.41	3.26	.0020
Best time at 'One-eleven'	.95	.09	.79	8.20	<.0001
<i>Step 2 R=.79, R²=.59, adjusted R²=.58, ΔR²=.09, F_{dt}=38.79, ΔF_{dt}=16.55, p<.0001</i>					
Step 3					
Age	.15	.32	.88	2.69	.0096
Duration per training unit	.86	.12	.40	3.33	.0016
Best time at 'One-eleven'	.98	.09	.71	7.36	<.0001
<i>Final model: R=.84, R²=.77, adjusted R²=.75, ΔR²=.26, F_{dt}=31.31, ΔF_{dt}=24.03, p<.0001</i>					

TABLE 3

Association of Skin-fold Thicknesses with Training Variables

	Years as active inliner	Weekly training units	Distance per training unit	Duration per training unit	Speed during training
Sum of skin-folds	.02	.09	-.05	-.04	-.19
Skin-fold front thigh	.04	.01	-.10	-.04	-.17
Skin-fold calf	.08	.04	-.01	-.02	-.16

*Note.*_ No association between the sum of skin-folds and the skin-fold of the lower limb with training variables.